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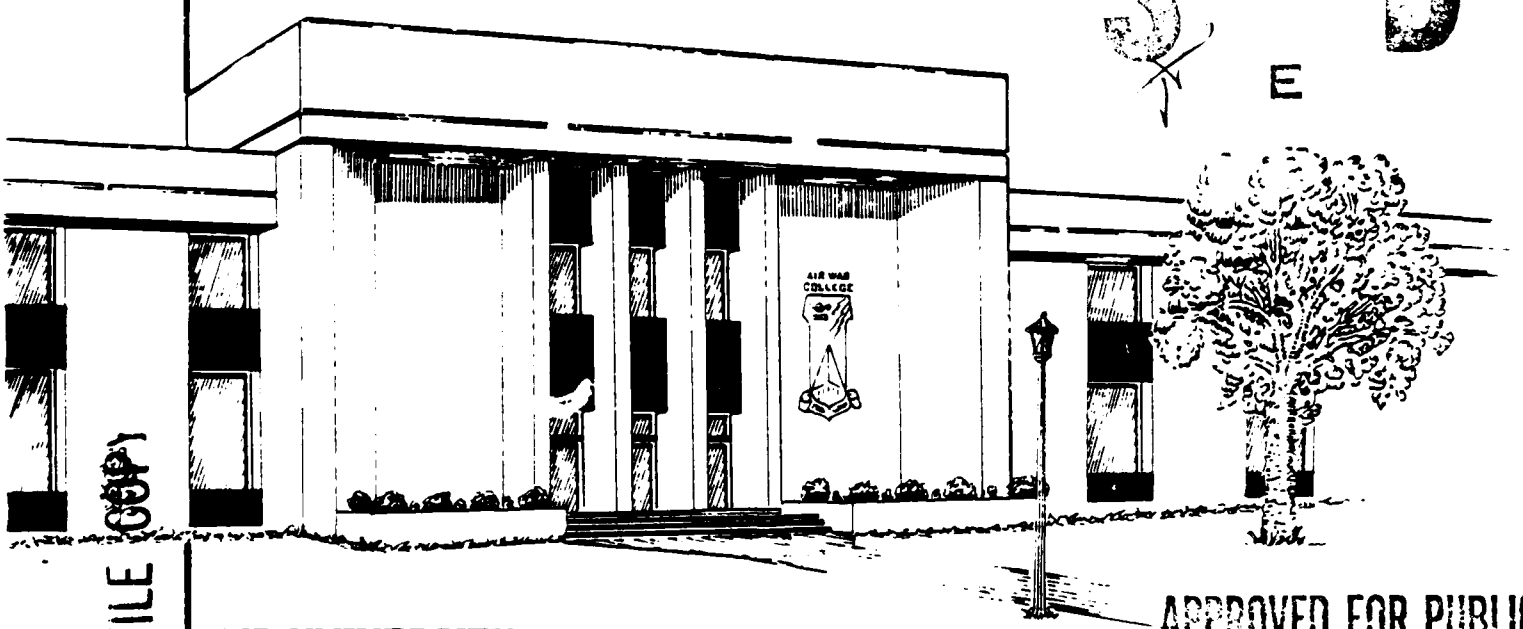
WORK MEASUREMENT: THE CONTROVERSY OVER MILITARY STANDARD 1567A

By COLONEL ROGER S. ALEXANDER



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WORK MEASUREMENT: THE CONTROVERSY OVER MILITARY STANDARD 1567A

by

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A RESEARCH REPORT SUBMITTED TO THE FACULTY

IN

FULFILLMENT OF THE RESEARCH

REQUIREMENT

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MAXWELL AIR FORCE BASE, ALABAMA

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DISCLAIMER-ABSTAINER

This research report reflects the views of the author and does not necessarily reflect the official opinion of the Air War College or the Department of the Air Force.

AIR WAR COLLEGE RESEARCH REPORT ABSTRACT

TITLE: Work Measurement: The Controversy over Military Standard 1567A

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For over ten years defense contractors have been resisting the requirement to implement disciplined work measurement systems. An explanation of the fundamentals of work measurement precedes a discussion of the value of contractor work measurement systems. An evaluation of the utility of the recently enacted requirement to report work measurement data to Congress follows.

BIOGRAPHICAL SKETCH

Colonel Roger S. Alexander (M.B.A., Southern Illinois University) was Director of Manufacturing for Air Force Systems Command in 1983 and 84 and in this capacity was instrumental in the formulation of policy for the application of MIL-STD-1567A, "Work Measurement". He began his career as an aircraft maintenance officer. Since 1974, following an Education With Industry tour with the Boeing Vertol Company, he has held a variety of positions in the contracting and manufacturing areas. Colonel Alexander is a graduate of the Armed Forces Staff College and the Air War College, class of 1986.

PREFACE

This paper is not intended to be a source document that will permit an indepth understanding of work measurement. It is merely a review of two aspects of an "acquisition issue" that has been festering for over ten years. The paper is intended to provide a review of this issue for the author to aid in his preparation for his subsequent assignment as Director of Contracting in a Systems Program Office, and nothing more. The Directorate of Manufacturing, Deputy Chief of Staff/Product Assurance and Acquisition Logistics, Headquarters Air Force Systems Command contributed significantly in the preparation of this paper.

INTRODUCTION

On 26 June 1985, the House of Representatives voted to amend the 1986 DOD Authorization Act to include a requirement for "cost and price management". The amendment instructs DOD agencies to gather and record a variety of cost, pricing and labor efficiency data so that it can be made available to Congress upon request. For new, major negotiated contracts, data is to be recorded by both prime and associate contractors for categories including cost of labor, materiel, subcontracts, overhead, profit and general and administrative expenses. In particular, the amendment insists labor costs are to be compiled using the "current industrial engineering standard hours of work content (also known as 'should-take' times) for the work." (1)

The passage of this amendment has been accompanied by strong rhetoric from the groups who have a significant interest in the area: Congress, the defense industry and the Department of Defense. Senator Charles Grassley (R-Iowa) is a central figure in the debate. At a seminar held in late June 1985 on Mil Standard 1567A, "Work Measurement", Senator Grassley directed the following remarks to the industry participants. "There is a general low-level of performance in the industry which simply has to be improved. There is overstaffing of assembly lines, there are serious quality control malfunctions that produce excessive scrap and rework, and there is simply inefficient management." He added, "There are many ways to save money in defense. And productivity improvement is the perfect place to start. Now that the defence budget is frozen, and since future budgets will likely be skimpy as well, the key to living with less money and avoiding cancellation or deferral of your company's program is to constantly increase the productivity and efficiency of your program. Work measurement and labor standards will become increasingly visible in the defense community." (2)

During Senate hearings on the subject, Richard Engwall of the Westinghouse Manufacturing Systems and Technology Center, testified on behalf of the Aerospace Industries Association. He stressed the industry's efficiency performance, saying, "There is no major difference between commercial and aerospace industry performance except that most commercial industry companies achieve standard in a shorter period of elapsed time due to significantly greater production volumes and rates as well as more long term program stability. Furthermore, product and process technology/specifications are much less complex than in the defense industry." He went on to say that work measurement "...adds little value to the product we manufacture and in many instances is being non-cost effectively imposed on us by the application of Mil Standard 1567A. (3)

Mr. Charles H. Hooper, Director of Manufacturing for Air Force Systems Command, supported Mil Standard 1567A as "a tool used by the Air Force Systems Command to reduce costs and increase productivity." He added that "it is not a panacea which will automatically cut the defense budget in half." The Air Force Systems Command "is determined to use work measurement data in contract pricing, negotiation and management." Mr. Hooper went on to say, however, that since "most defense systems, because of their relatively low production volume and frequent design improvements, never reach 'mature production', the data provided to Congess should be considered with extreme caution." (4)

What is going on here? Why is the United States Congress legislating the use of work measurement in defense contractor plants? Why is the United States Congress requiring data based on 'industial engineering standard hours' to be provided upon request? This paper will attempt to sort this controversy out. I will first address the utility of using Mil Standard 1567A, "Work Measurement",

as a cost reduction and productivity improvement tool, then I will consider the utility of collecting and providing data based on a work measurement system to Congress to permit relative contactor efficiencies to be determined.

WORK MEASUREMENT FUNDAMENTALS

In order to understand the utility of Mil Standard 1567A we must first understand the fundamentals of work measurement. The foundation of a work measurement system is the labor time standard. The labor time standard is established by contactor industrial engineers. It represents the time a particular task "should take" during mature production, which is normally considered to by reached by the production of unit 1000.

There are six elements which are considered when a labor time standard is developed:

1. Training. The worker is assumed to be adequately trained.

2. Pace. The worker is assumed to be performing at a "normal" pace.

3. Unit of work. The task to be accomplished (for example, rivet part A to part B) is completely described.

4. Manufacturing method. Labor time standards are totally dependent on the particular method chosen. (Two companies may make an identical component, but if their "methods" are not identical, the labor time standards associated with producing the product will be completely different.)

5. Working conditions. Changes in working conditions (for example, from a well-lighted, air conditioned factory to outside in heat and humidity) will impact the labor time standard.

6. Quality. The work is assumed to result in a product of acceptable quality. No rework and repair is considered as part of the task.

By comparing the labor time standard to the hours that were actually expended to complete the task, the contractor (and the government) can:

1. Gain visiblity into labor inefficiencies at the level at which the problems occur.

2. Use the labor time standard as the ultimate performance objective.

3. Evaluate alternate manufacturing methods by comparing the labor time standards required to complete a task using one method with those required using an alternate method.

4. Gain pricing and negotiation insight by using performance against labor time standards as a tool to quantify past performance and forecast future improvements.

A good work measurement system should meet the following criteria:

1. Establish the most cost-effective manufacturing method to complete a particular task.

2. Set sufficiently precise labor time standards to provide a sound foundation from which to measure and improve manufacturing labor performance.

3. Apply the labor standards to at least 80 percent of the direct manufacturing labor hours necessary to build a particular product. (Additional coverage of direct manufacturing labor hours may not be appropriate since the remaining tasks could be sufficiently complex and non-repetitive to preclude spending the funds associated with developing precise labor standards.)

4. Measure the actual hours expended and compare them to the labor time standards.

5. Analyze the difference between the actual time and the "standard" time. This difference is the "variance to standard" and is often termed "inefficiency".

6. Set aggressive performance improvement goals with "standard" as the ultimate objective.

7. Take appropriate corrective action to reduce variance and meet performance improvement goals.

8. Establish an effective "methods improvement" program to improve operations and reduce the labor content of individual manufacturing processes.

9. Maintain the labor time standard as the manufacturing method changes over time.

10. Use the labor time standard data (the relationships between "actual" and "standard" hours) to budget, plan, schedule and estimate manufacturing requirements.

Mil Standard 1567A defines a system that encompasses the criteria outlined above. The approach the standard defines includes the requirement for a basic structure that will permit the work measurement system to function effectively. The contractor is required to establish the following enabling mechanisms:

1. A work measurement plan and supporting procedures.

2. A clear designation of the organization and personnel responsible for the execution of the system.

3. A plan to establish and maintain engineered labor standards of known accuracy.

4. A plan to continue to improve work methods in connection with the established labor standards.

5. A defined plan for the use of labor standards as an input to budgeting, estimating, production planning, and "touch labor" performance evaluation.

6. An internal audit system.(5)

The Mil Standard is applicable to new and follow-on procurements for full-scale development programs which exceed $100 million and for production and/or major systems modifications which exceed $20 million annually or $100 million cumulatively. It also applies to subcontracts valued a $5 million annually or $25 million cumulatively. It does not apply to contracts or subcontracts for construction, facilities, off-the-shelf commodities, time and materials, research, study and developments which are not connected with an acquisition program. It does apply to firm fixed price as well as cost type contracts. And it does apply to depot level maintenance valued at $20 million annually or $100 million cumulatively. (5) Through this set of criteria Air Force Systems Command alone has programs worth over $30 billion that are subject to the provisions of the Standard. (7)

ARE CONTRACTOR WORK MEASUREMENT SYSTEMS WORTHWHILE?

The approach outlined by the Mil Standard seems to be reasonable. The benefits that can be realized through systematic development of standards and systematic comparison of actual hours to the standards are obvious. Why then have the defense contractors been so adamently opposed to the imposition of the Mil Standard? Has it been because it is not cost effective? In 1980 the Government Accounting Office (GAO) examined this question and concluded that the Mil Standard is indeed cost effective. The report concluded that dramatic productivity improvements and cost savings are being realized at contractor plants where the standard has been applied. Several examples of positive results were given. In one instance one Boeing Aerospace Company production line's performance to standard improved by 20 percent in two years. According to the report, "the Air Force estimates that Boeing achieved a gross savings of about $31.3 million with an investment to implement the system of about $1.3 million - a return on investment of about 17 to 1." (8)

The report went on to say, "where implemented by the Air Force, anticipated problems by industry, DOD and all services in getting the Mil Standard on contract have not surfaced and productivity increases and related cost control benefits have been dramatic, even in the early stages of implementation." The GAO went on to say that contactors apparently have proposed no visible costs to the contractual requirements of the Mil Standard. Government contract administration officials said that it acually makes administration of the contract simpler and less costly because it is compatible with existing management systems and not redundant. (9)

If application of the Standard is cost effective, as the GAO maintains, what then can industry possibly object to? When the Mil Standard was first introduced on 30 June 1975 industry characterized the approach as "deterrent to free enterprize", "galloping socialism," and "cost prohibitive-administrative monster". The prevalent attitude of industry in 1975 was reflected by the following statement, "The question is not the adequacy of the proposed MIL-STD-1567, the question is whether any customer, including the Government, has a right to coerce private industry by a system of checks and balances on their internal management practices." (10)

Ten years later, at a conference hosted by Air Force Systems Command on 20-21 February 1985, industry had exchanged their emotional reaction for a more reasoned set of objections. One cannot resist speculation that the revelations of $300 hammers and $6,000 toilet seats supported the Government's "right to coerce private industry by a system of checks and balances on their internal management practices." Industry's position at the Feb 85 meeting was as follows. The continuing emphasis on Mil Standard 1567A is inappropriate because:

1. Direct labor is a small percent of total cost and growing smaller.

2. Direct labor is already the most measured cost element.

3. Other cost reduction initiatives have more potential to include overhead reduction, producibility engineering and planning, low risk transition to production, Manufacturing Technology, Technology Modernization, quality improvement initiatives, work-in-process inventory reduction and participative management programs. (11)

While offering the above objections, industry did concede that the basic intent of Mil Standard 1567A is good, but that most contractors already have work measurement systems that meet that intent. In other words, the work measurement systems that already exist aim toward reducing costs and improving productivity, and therefore imposition of the requirements of Mil Standard 1567A is unnecessary and burdensome. (12)

Air Force Systems Command (AFSC) agreed with the contractors that Mil Standard 1567A was but one of many cost reduction and productivity improvement tools that were available. AFSC also recognized that most contractors did have work measurement systems, however they were concerned that those systems were not as effective as they could be. In 1983 and 1984 AFSC conducted a series of "productivity reviews" of contractor operations. One major focus of the reviews was to evaluate the work measurement systems. The composite findings are as follows:

Work Measurement Indicator	AFSC Assessment (13)
Establish Method	Fair
Set Standard	Good

Engineered Standard Coverage	10-95% Range
Measure Actuals	Good
Analyze Variance	When Over Budget
Establish Goals	To Budget
Corrective Action	When Over Budget
Improve Methods	Weak
Maintain Standards	Weak
Standards Used for Estimating	Approx. 1/2 of Cases

The key word used in the AFSC assessment is "budget". It appears that contractors are using the amount of hours or dollars budgeted to be the performance baseline and that standard hours are used only for allocating the budget. Once the budget has been negotiated, reduction below the budget curve is unusual. AFSC also found that historical actuals were used as the starting point of performance curves. It was also unclear as to what the relationship of standard hours were to projected actual touch labor hours in the preparation of pricing proposals. In summary it appeared that historical performance becomes the estimate, which, in turn, becomes the budget, which becomes the performance goal. In other words contractors are not basing their performance objectives on what a task "should take" they are basing their goals on what it "did take". (14) Contractor's work measurement systems are not operating as they should operate: they are not in conformance with Mil Standard 1567A.

What this all boils down to is that contractors resist anything that will reduce their profitability. Unfortunately, the Government procurement rules dictate that profit will be a percent of cost. Thus anything that is done to reduce costs (improve productivity) results in a reduction of profitability.

Mil Standard 1567A strikes directly at this equation, and the contractors are resisting to the best of their ability. Fortunately, it appears that slow progress is being made to implement the Mil Standard, however, it is remarkable that the United States Congress has had to get into the act to ensure that progress continues.

SHOULD CONTRACTOR WORK MEASUREMENT DATA BE REPORTED TO CONGRESS?

If it makes sense to insist that contractors operate work measurement systems that conform to Mil Standard 1567A, does it also make sense to report the results of those systems to Congress in order that an "efficiency" judgement can be made? There are several phenomena that operate in the world of weapon systems development and manufacturing that militate against being able to make a meaningful comparison of contractor's work measurement data. Even if the contractor's work measurement system does meet the requirements of Mil Standard 1567A there is sufficient flexibility in the Standard such that differences can exist between systems. For example the techniques and definitions by which labor time standards are established can vary significantly. Accuracy requirements of labor time standards can vary from within + or - 10 percent to "estimated" standards for which there are no accuracy requirements. Some contractors include in their "standard" some provision for inefficiency and use that "adjusted standard" as the baseline from which to measure performance. Some contractors include "set-up" (planned work necessary to get ready to perform a task) as a "variance" or "inefficiency". Others include "set-up" in the labor time standard. For the small lot sizes typical of the defense industry, set-up labor hours can be substantial. Mil Standard 1567A provides broad criteria which the contractor's work measurement system should meet. It does not eliminate all differences in work measurement systems. (15)

Another factor requiring caution when attempting to evaluate relative contractor performance is the "phase" of the program. During program development, design and manufacturing instabilities are common. Due to their relatively high cost, precise "engineered" labor time standards are generally not established until manufacturing methods and processes have been stabilized. Estimated standards are usually used during development. Even after transitioning to production, and the establishment of "engineered" standards, some inefficiencies remain because of the complexity of the manufacturing processes. Thus it would be invalid to compare a contractor who is in the development phase of a program to a contractor who is mature production. .3

During development and production, the contractor is expected to make significant, steady progress to drive actual manufacturing labor performance toward the labor time standard. However, weapon system performance is continuously reviewed and improved as technology, and the threat, changes. These changes often require manufacturing process changes, which then must be developed and refined. This serves to delay achievement of true "mature" production. Weapon systems in development or early production cannot be expected to be produced as efficiently as those in mature production. These program differences, as well as the differences in the labor time standards themselves, make comparison of separate contractors, or even comparison of separate programs within the same contractor facility, extremely difficult. .4

There is another factor which makes comparison of work measurement data risky. Contractor efficiency is often represented by a "performance index." A performance index is the ratio of actual hours required to perform a task to [illegible] hours allowed by the labor standard. A performance index of 1.00, for example, means that actual hours to accomplish a task

[illegible] should have taken 1 hour to accomplish(or took 1.63 times longer than [illegible] was determined to be "standard"). The use of the performance index is further complicated by the improvement of "manufacturing methods". A manufacturing method is the way that a specific task is accomplished, i.e. the definition of the tools to be used and the steps to be taken to accomplish a specific unit of work.

An example of the risk associated with the concepts defined above can be seen in data that was actually provided to Congress. Early in the production cycle of a particular program, the ratio of "actual" to "standard" hours was 1.63 (first quarter FY 83). This "performance index" was reduced to 1.34 one year later (first quarter FY 84). By the first quarter of FY 85, however, the performance index had increased to 1.47. One might conclude from this data that program performance was degraded and that the Air Force should take action against the contractor. This conclusion would not be correct. Although the performance index increased between the end of the first quarter of FY 84 and the end of the first quarter of FY 85, the "actual" manufacturing hours required to produce a unit had declined from 948 to 833. Despite a higher performance index, the cost to the government was less. The contractor had undertaken an aggressive program to drive manufacturing hours out of production processes by developing and implementing better, more efficient manufacturing methods. If the Air Force had required the contractor only to drive down the performance index, there would have been little or no emphasis on methods improvement. The Air Force would have a very efficient, but not necessarily effective, contractor. (13)

One last comment on comparing contractor performance is in order before concluding this paper. There has been a propensity for Congress and the press

to compare defense contractors with manufacturers of commercial products. This comparison is extremely difficult, if at all feasible, and must be approached with extreme caution. Generally, techniques used to develop labor time standards are consistent, regardless of industry. However, the defense industry can be characterized as one of limited production volume of extremely complex, state-of-the-art equipment and systems. This complexity means that the "cycle times" (aggregates of individual labor time standards required to complete specific tasks) for processes common to defense systems are extremely long, often as much as 20 to 30 hours. This is especially true in final assembly where some operations exceed 80 hours.

Most commercial businesses which apply labor standards are high volume producers of relatively simple equipment. Process cycle times generally range from seconds to minutes. These extremely repetitive, short cycle operations are inherently more efficient than less repetitive, long cycle operations. Long cycle operations contain more work elements to be sequentially performed. And more work elements mean more potential for error. There is considerable unavoidable delay to recheck instructions, repeat steps performed, and determine the specific method to be used in intermediate process steps. (19)

CONCLUSION

What can we conclude from all of this? Does it makes sense to insist that defense contractors use a work mesurement system that complies with the requirements of Mil Standard 1567A? Does it makes sense to report the results of those systems to Congress so that an "efficiency" judgement can be made? Work measurement systems are an excellent management tool to monitor, evaluate, and improve manufacturing labor performance. Properly applied, they can reduce

labor hour content and thus reduce the cost of weapon systems to the government. Their utility, however, is confined to single contractor operations, i.e., work measurement systems only permit contractors to accurately measure their own performance against their own ideal. There are too many variables involved to enable a meaningful comparison to be made between contractor operations. The factors of production phase, complexity of the system being manufactured, the number and magnitude of design changes and the aggressiveness of the methods improvement program all influence the results of the work measurement system.

FOOTNOTES

1. "Federal Beat." Industrial Engineering (October 1985), pp. 11-12.

2. "Federal Beat." Industrial Engineering (August 1985), p. 8.

3. "Federal Beat." Industrial Engineering (October 1985), pp. 11-12.

4. ibid., p. 12.

5. Military Standard 1567, "Work Measurement." (30 June 1975), pp. 3,4 and 6.

6. ibid., p. 1.

7. Air Force Systems Command Briefing, "Air Force Systems Command Contractor Work Measurement Program." presented to SAF/FM February 1984.

8. U.S. General Accounting Office, "Military Standard on Work Measurement -- A Way to Control Cost and Increase Productivity." (PSAD-80-46, 3 June 1980).

9. "Federal Beat." Industrial Engineering (September 1980), pp. 11-12.

10. Charles H. Boyer, "Work Measurement: The Flap Over MIL-STD-1567(USAF)." Industrial Engineering (November 1976) pp. 14-25.

11. Air Force Systems Command letter to attendees of 20-21 February 1985 Work Measurement Meeting, Kirtland AFB, New Mexico. (18 March 1985), "Attachment 1 - Summary of Industry Comments, Concerns and Recommendations."

12. ibid.

13. ibid., "Attachment 2 - Air Force Systems Command Response to Industry Comments, Concerns and Recommendations."

14. ibid.

15. Air Force Systems Command talking paper, "Air Force Systems Command and Work Measurement." (undated) pp. 3-5.

16. ibid.

17. ibid.

18. ibid.

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